

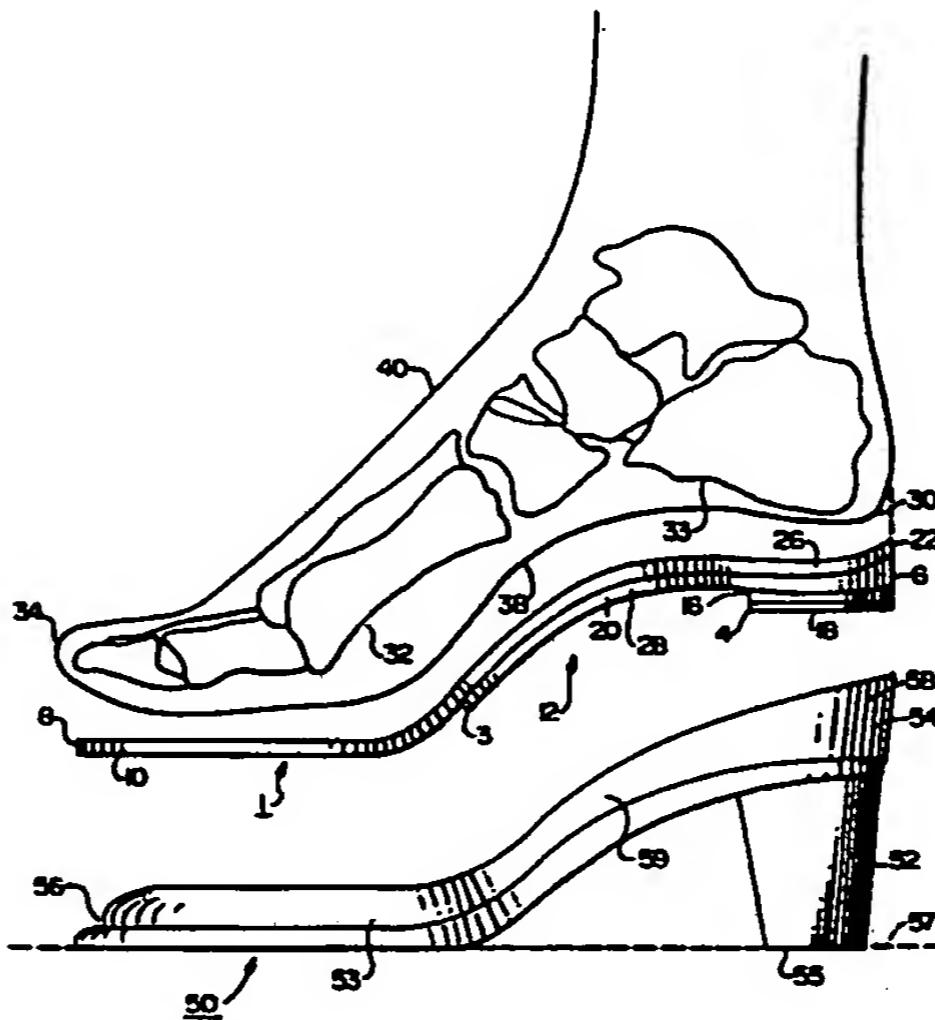
PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(54) Title: HIGH-HEELED SHOE ORTHOTIC DEVICE



(57) Abstract

An orthotic device for insertion into a high-heeled shoe is provided, which orthotic device virtually eliminates the problems associated with the wearing of high-heeled shoes, particularly pronation effects, general foot discomfort, posture problems, toe pain, and arch pain. The orthotic device comprises a rigid or semi-rigid shell (28) for positioning beneath the heel (30) of the foot (40) and extending forwardly towards the toes (34) of the foot (40). The shell (28) terminates behind the five metatarsal heads (32) of the foot (40), and is shaped whereby to permit the first metatarsal head freely to evert and plantarflex under load, and is shaped such that the heel (30) of the foot (40) is carried substantially parallel to or slightly backwardly inclined relative to the ground plane.

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1 HIGH-HEELED SHOE ORTHOTIC DEVICE

2 Background of the Invention

3 Field of the Invention

4 This invention relates generally to orthotic devices,
5 and more specifically to orthotic devices for use in high-
6 heeled shoes.

7 The human foot may be subject to a number of
8 abnormalities which cause pain. A number of corrective
9 constructions have been devised for curing these problems.
10 These corrective constructions are generally referred to
11 in the art as "orthotics" and may be integrally formed in
12 a shoe or adapted to be received by a shoe. Such orthotic
13 devices commonly are used to correct abnormalities and/or
14 to prevent foot problems or injury arising from the
15 wearing of high-heeled dress shoes. While there has been
16 substantial investigation by prior art workers into
17 orthotic devices for use with athletic footwear, there has
18 been little work into designing orthotics for reducing
19 injury or increasing comfort of high-heeled dress shoes.

20 A standard high-heeled dress shoe is designed so that
21 the heel of the foot wearing the shoe is carried higher
22 than its toes. The height differential between the heel
23 and the toes can vary significantly depending on the style
24 of the shoe. It is not uncommon for heel heights to range
25 from 1 1/2" to 3" or more above the toes in certain
26 styles. Also, high-heeled shoes typically are designed
27 with pointed toes in order to exhibit greater fashion
28 appeal. While the design of these pointed toes also vary,
29 it is generally common for fashion high-heeled shoes to
30 maintain pointed toes regardless of the shape of the
31 wearer's foot. A number of painful foot problems result
32 from this design. For example, the downward slant of the
33 inner sole of the shoe forces the wearer's foot to slide
34 forward toward the toes. As the foot slides forward, the
35 toes become jammed in the toe portion of the shoe. This
36 can be very painful and it has been shown that at least

1 85% of all high-heeled shoe wearers experience such pain.
2 Moreover, the downside slant of the inner sole places
3 stress on the foot as the foot attempts to conform to the
4 downward slant of the inner sole, causing the heel bone or
5 calcaneus, to tilt downward, or plantarflex, thereby
6 locking the first metatarsal phalangeal joint and
7 preventing hallux extension or "toe lock". This causes
8 the foot to pronate, greatly decreasing the overall foot
9 comfort as well as adversely effecting the wearer's
10 posture and ambulation all as described in U.S. Patent
11 4,597,195 to Dananberg, one of the inventors hereof.
12 Therefore, wearers of high-heeled shoes often complain of
13 problems associated with toe pain, arch pain, as well as
14 general lower back problems.

15 Unfortunately, no teaching exists in the prior art to
16 construct an orthotic device that adequately corrects foot
17 posture while permitting conventional high-heeled shoes to
18 be worn. Typically, an orthotic device consists of
19 several components: the heel post or rear stabilizer
20 component located directly beneath the heel seat of the
21 orthotic, the shell or arch accommodating section which
22 runs from the heel to a point just behind the metatarsal
23 heads of the foot; and the extension component that runs
24 from a point at the end of the orthotic shell to the point
25 where the toes join the body of the foot, commonly called
26 the sulcus.

27 Richardson et al, U.S. Patent No. 1,778,002 discloses
28 an orthotic in which the shank is provided with extension
29 which are intended to act as an arch support. The shank
30 extensions contemplated in Richardson extend laterally
31 from the shank of the sole, extending outwardly at an
32 acute angle with respect to the sole. The disadvantage
33 of this construction is that it requires a sole with
34 relatively high sides to protect or conceal Richardson's
35 orthotic device. Moreover, the wider or higher such
36 lateral extensions are, the more pressure may be exerted

1 on the side or arch, vamp, foxing, and order of the shoe,
2 thereby distorting the shape of the shoe itself.

3 It is also known in the prior art to provide orthotics
4 comprising pads attached to the insole. These may take
5 the form of metatarsal pads, midtarsal pads, or heel spur
6 pads, such as those disclosed by Riehle et al, U.S. Patent
7 No. 1,867,679, Frese, Jr. in U.S. Patent No. 2,959,875,
8 Nalick, U.S. Patent No. 3,777,419, and Stemmons, U.S.
9 Patent No. 2,075,552.

10 Riso et al, U.S. Patent No. 4,250,886 discloses an
11 orthotic for a high-heeled shoe and comprising a sole
12 including heel and forefoot receiving portions, the heel
13 portion being elevated approximately 1 1/2" about the
14 forefoot portion. Riso's orthotic also provides a
15 metatarsal pad secured to the sole and dimensioned so as
16 to have one marginal edge substantially adjacent and
17 proximal to the head of the second metatarsal, a second
18 metatarsal edge substantially adjacent and lateral the
19 first metatarsal and a third metatarsal edge substantially
20 adjacent and medial to the fifth metatarsal. However,
21 Riso requires that the orthotic position of the foot such
22 that a constant height of 1 1/2" is maintained between the
23 heel and forefoot even if the heel height exceeds 1 1/2".
24 Thus, in a shoe with a standard heel height of 1 3/4" an
25 orthotic made in accordance with Riso would place a 1/4"
26 pad under the forefoot to maintain the constant 1 1/2"
27 between the heel and the forefoot, and a 2" heel would
28 require a 1/2" pad under the forefoot. The inclusion of a
29 pad of 1/4" - 1/2" thickness in a modern high-heeled shoe
30 would crowd the wearer's toes, resulting in toe pain, and
31 exacerbating the problem of toe lock discussed in
32 Dananberg U.S. Patent 4,597,195.

33 Objects of the Invention

34 An object of the present invention is to provide an
35 orthotic device adapted for insertion into a high-heeled
36 shoe which overcomes the aforesaid and other problems of

1 the prior art. A more specific object of the present
2 invention to provide an orthotic device that is capable of
3 eliminating toe pain and toe lock of the wearer of a high-
4 heeled dress shoe.

5 Yet another object of the present invention is to
6 provide an orthotic device that is capable of improving
7 the wearer's posture, general foot comfort, and of
8 eliminating foot arch pain as well as general lower back
9 pain.

10 A still further object of the present invention is to
11 provide an orthotic device that is useful in high-heeled
12 shoes having a wide range of heel heights including heel
13 heights of two or more inches.

14 Summary of the Invention

15 The present invention provides an orthotic device
16 adapted to be inserted into a heeled shoe defining a
17 ground plan and also being adapted for receiving a human
18 foot thereon. The orthotic device contemplated by the
19 instant invention comprises a rigid or semi-rigid shell
20 for positioning beneath the heel of the foot, and
21 extending forwardly toward the toes, but terminating
22 behind all of the five metatarsal heads, and is shaped
23 such that the first metatarsal head specifically can be
24 allowed to plantarflex and evert under load. The rigid or
25 semi-rigid shell has a shape such that the heel of the
26 foot is carried substantially parallel to the ground
27 plane, or the heel is tilted slightly backwards.

28 Typically, the part of the shell underlying the heel will
29 be tilted at an angle of from about 4 to about 22.5
30 degrees to accommodate for the downward slant of the shoe.
31 The actual angle is related to shoe heel height. The
32 higher the heel, the greater the accommodative angle.

33 In a preferred embodiment of the invention the
34 orthotic device also comprises a heel post attached to the
35 shell for positioning beneath the heel of the foot, and
36 extending forwardly toward the toes of the foot. The heel

1 post terminates behind the heel bone of the foot and is
2 adapted to assist the shell in carrying the heel of the
3 foot in a substantially parallel position relative to the
4 ground plane. Also, in a preferred embodiment of the
5 instant invention the heel post has a thickness that
6 assists the shell in carrying the heel of the foot in a
7 substantially parallel or slightly tilted back position,
8 and specifically may have a thickness that increases from
9 the heel of the foot towards the toes thereof and from an
10 outer portion of the foot towards the arch thereof.

11 Other variations and modifications are possible. For
12 example, the curved portion of the shell is adapted as a
13 function of the height of the heel of the shoe above the
14 ground plane in order better to carry the heel of the foot
15 in the aforementioned substantially parallel or slightly
16 tilted back position relative to the ground plane. Also,
17 in other modifications, the orthotic device may also
18 comprise a recessed heel portion that is adapted to
19 receive the heel of the foot, and a cushioned, flexible
20 extension component is attached to the shell and
21 positioned beneath the heel, and extending forwardly
22 toward the toes of the foot to terminate behind the sulcus
23 of the foot.

24 Brief Description of the Drawings

25 Other features of the present invention will become
26 apparent as the following description proceeds and upon
27 reference to the drawings, wherein like numerals represent
28 like parts and, in which:

29 Figure 1 is a top view of one preferred embodiment of
30 the instant invention;

31 Figure 2 is a side view along the inward portion of
32 the preferred embodiment depicted in Figure 1;

33 Figure 3 is a side view of an outward portion of the
34 preferred embodiment depicted in Figures 1 and 2;

35 Figure 4 is a bottom view of the preferred embodiment
36 depicted in Figures 1-3;

1 Figure 5 is a diagrammatic view of the embodiment
2 depicted in Figures 1-4 with the skeletal outline of a
3 human foot disposed thereon;

4 Figure 6 is a top view showing details of the toe end
5 of the orthotic device made in accordance with the present
6 invention;

7 Figure 7 is a side view similar to Figure 2, and
8 showing details of a heel post construction in accordance
9 with the present invention; and

10 Figure 8 is a bottom view of the alternative
11 embodiment depicted in Figure 7.

12 While the present invention will hereinafter described
13 in connection with preferred embodiments and methods of
14 use, it will be understood by those skilled in the art
15 that it is not intended to limit the invention to these
16 embodiments. On the contrary, it is intended to cover all
17 alternatives, modifications, and equivalents, as may be
18 included within the spirit and broad scope of the
19 invention as defined only by the appended claims.

20 Detailed Description of the Preferred Embodiments

21 Turning to the drawings, there is provided an orthotic
22 device 1 adapted to be inserted into a high-heeled shoe 50
23 which is shown relative to a ground plane 57 formed by the
24 intersection of the bottom 53 of the foreshoe 56 and the
25 bottom 55 of the heel 52. The orthotic device 1
26 contemplated by the instant invention is adapted for
27 receiving a human foot 40 thereon and comprises a rigid or
28 semi-rigid shell 28 for positioning beneath the heel 30 of
29 the foot 40 and extending forwardly toward the toes 34 of
30 the foot 40. Referring in particular to Figure 6, at the
31 forward or toe end 3 of the rigid or semi-rigid shell 28,
32 i.e. at the point on the orthotic where the first
33 metatarsal shaft comes in contact with the shell, an area
34 is removed from the shell so as to permit the first
35 metatarsal head to evert and plantarflex under load. More
36 particularly, from a point approximately 1 cm distally

1 (towards toes) from the base of the first metatarsal head,
2 material is removed on an approximate 20 degree angle from
3 the medial side of the orthotic. This is carried to a
4 point approximately 1 cm from the toe end of the shell 28.
5 A second cut with material removed is then made 20 to 25
6 degrees to the first cut, and this terminates at the end 3
7 of the shell 28 adjacent to the medial side of the second
8 metatarsal of the foot 40. Shell 28 is shaped, as shown
9 in Figure 5, such that the heel 30 of the foot 40 is
10 carried substantially parallel or inclined slightly
11 backward to the ground plane 57. In the particular
12 embodiment illustrated in the instant figures, the instant
13 orthotic device also comprises a heel post 16 that is
14 attached to the shell 28 and also positioned beneath the
15 heel 30 of the foot 40. The post 16 extends forwardly
16 toward the toes 34 of the foot and terminates at 4 behind
17 substantially immediately the heel bone 33 of the foot 40.
18 Preferably, the post 16 is adapted to assist the shell 28
19 in carrying the heel 30 in the substantially parallel or
20 slightly backwardly inclined position relative the ground
21 plan 57. Also, preferably, the heel post 16 is of a
22 thickness to assist the shell 28 in carrying the heel 30
23 by increasing the thickness of the post 16 from the heel
24 30 or back part of the orthotic 6 toward the toes 34 or
25 front part 8 of the orthotic and from an outer part 14 of
26 the foot 40 toward the arch 38 or inner portion 12
27 thereof. Preferably, as shown in Figures 7 and 8, post 16
28 extends from a point under the most distal (toe side)
29 portion of the shell 28 under the heel approximately 1-1.5
30 cm so as to accommodate the slant of the high-heeled shoe
31 without raising the heel of the wearer out of the back of
32 the counter.

33 Further preferably, the shell 28 at a mid portion 20
34 corresponding to the arch 38 of the foot 40 is curved to
35 provide support to the arch 38. Preferably, the curvature
36 of the shell 28 increases from the back portion 6 of the

1 orthotic to a maximum at the midpoint 20 of the shell 28
2 and then decreases toward the termination point 3 and also
3 increases from the outward portion 14 towards the inward
4 portion 12. Other curvatures are also possible, so long
5 as any such curvature is adapted to properly support the
6 arch 38 of the foot 40 with the heel 30 of the foot 40
7 carried substantially parallel to or inclined slightly
8 backwardly to the ground plane, and the shell terminates
9 slightly rearwardly of the first metatarsal head 32 of the
10 foot 40.

11 Additionally, the orthotic device made in accordance
12 with the present invention may comprise a cushioned,
13 flexible extension component 10 that is attached to the
14 shell 28 and is also positioned beneath the heel 30 and
15 extends forwardly toward the toes 34 of the foot 40. The
16 extension component 10 terminates at 8 behind the sulcus
17 of the foot 40. Preferably, the extension component is
18 made of a soft cushioning material such as PPT, or other
19 soft cushioning materials as are well known in the art.
20 Furthermore, although the shell 28 and heel post 16 are
21 preferably formed of a hard rigid substance such as
22 plastic or hard foam, other materials may also be used so
23 long as such materials allow the heel 30 of the foot 40 to
24 be kept substantially parallel or inclined slightly
25 backwardly to the ground plane 57.

26 In use, the orthotic device 1 is placed within a high-
27 heeled shoe 50 so that the back end 6 of the device 1 is
28 flush with the back 58 of the top portion 54 of the shoe
29 50 and the front or toe portion 8 of the device is nearby
30 the front 56 part of the shoe 50 and point 3 terminates
31 slightly rearwardly of the first metatarsal bend 32 of the
32 foot. In this embodiment, the extension component 10 is
33 within the forefoot 53 while the shell 28 is carried
34 within the incline portion 59 and the heel post 16 is
35 carried directly above the heel 52. When the foot 40 is
36 inserted into the shoe 50 and placed on top of the

1 orthotic 1, preferably, the heel 30 is received into a
2 recessed heel portion 26 that has been so adapted to
3 receive the heel 30. The arch 38 of the foot is carried
4 and supported by the curved portion of the rigid or semi-
5 rigid shell 28, while the first metatarsal head 32 of the
6 foot is left unsupported by the orthotic, and thus is free
7 to flex. The entire foot, however, rests upon the
8 cushioned flexible extension component 10 to provide
9 additional wearer comfort.

10 As will be seen by those skilled in the art, the
11 instant orthotic device provides many advantages over the
12 prior art. Most important among these advantages is that
13 the heel 30 of the foot 40 is carried by the orthotic 1
14 such that it is substantially parallel to or inclined
15 backwardly to the ground plane 57. This greatly reduces
16 the forward inclination force of the foot 40 toward the
17 toe part 56 of the shoe 50 and therefore prevents the toes
18 34 of the foot 40 from becoming jammed therein, thus
19 increasing general foot comfort and also improves posture.
20 Thus, it would be appreciated that the instant orthotic
21 eliminates the toe pain and general lower back pain
22 associated with the wearing of heeled shoes and
23 particularly the wearing of high-heel shoes. Also, since
24 the arch 38 is supported by the curved portion of the
25 shell 28, while the first metatarsal head is left
26 unsupported by the orthotic, the first metatarsal is free
27 to evert and plantarflex under load. Thus, arch pain,
28 endemic with the use of high-heeled shoes, is virtually
29 eliminated using the instant orthotic.

30 Also, advantageously, the instant invention permits
31 many variations without departing from the instant
32 invention. For example, the thickness and thickness
33 distribution of the heel post 16 may be adapted as
34 necessary in order to keep the heel 30 of the foot 40 in
35 substantially parallel or slightly backwardly inclined
36 relationship to the ground plane 57. Thus, for example,

1 in heels having 1" or less height, the thickness of the
2 post will be slight as compared to the height of the back
3 58 of the shoe 50, while in shoes with greater heel
4 height, for instance, 2", the thickness of the post 16 may
5 be made thicker toward the toes 34 or front end 8 of the
6 orthotic so as to accommodate the increased angle of the
7 arched portion 59 of the shoe 50 relative to the ground
8 plane 57. Thus, it can be seen, that a great many
9 alterations may be made to the instant orthotic to account
10 for changes in heel heights relative to the ground plane
11 57. Indeed, if needed, the heel post portion 16 may be
12 eliminated entirely so that the shell 28 rests directly
13 above the heel 52 of the shoe 50.

14 It is, therefore, evident that there is provided, in
15 accordance with the present invention, an orthotic device
16 that fully satisfies both the aims and objectives
17 hereinbefore set forth. While this invention has been
18 described in conjunction with specific embodiments
19 thereof, it will be evident to those skilled in the art
20 that many alternative, modifications, and variations are
21 possible without departing from the scope of the instant
22 invention. Accordingly, it is intended to embrace all
23 such alternatives, modifications, and variations as fall
24 within the spirit and broad scope of the appended claims.

1 CLAIMS

2 What is claimed is:

3 1. An orthotic device for insertion into a high-
4 heeled shoe for a human foot, said shoe having a foreshoe
5 and a heel, each having a bottom, the intersection of
6 which defines a ground plane, said device characterized
7 by:

8 a. a shell 28 dimensioned to underlie the heel 30
9 of said foot 40 and extending forwardly toward the toes 34
10 of said foot, said shell terminating behind the five
11 metatarsal heads 32 of said foot so as to permit the first
12 metatarsal head freely to evert and plantarflex under
13 load; and

14 b. a heel post 16 attached to said shell and
15 dimensioned to underlie the heel of said foot and
16 extending forwardly toward the toes of said foot, said
17 heel post terminating adjacent the heel bone 33 of said
18 foot, said heel post and said shell having a thickness
19 distribution to carry said heel of said foot backwardly
20 inclined at an angle of between about 4 degrees and about
21 22.5 degrees relative to the ground plane.

22 2. An orthotic device according to claim 1, and
23 further characterized by a cushioned, flexible extension
24 component 10 attached to said shell and extending
25 forwardly toward and dimensioned to at least partially
26 underlie the toes of said foot.

27 3. An orthotic device according to claim 2,
28 characterized in that said cushioned, flexible extension
29 component 10 terminates behind the sulcus of the foot.

30 4. An orthotic device according to claim 1, and
31 further characterized by a recessed heel portion 26
32 dimensioned to underlie the heel of said foot.

33 5. An orthotic device according to claim 1,
34 characterized in that said shell has a curved portion 20
35 dimensioned to underlie and support the arch 38 of said
36 foot.

1 6. An orthotic device for insertion into a high-
2 heeled shoe for a human foot, said shoe having a foreshoe
3 and a heel, each having a bottom, the intersection of
4 which defines a ground plane, said device characterized by
5 a shell 28 dimensioned to underlie the heel 30 of said
6 foot 40 and extending forwardly toward the toes 34 of said
7 foot, said shell terminating adjacent the five metatarsal
8 heads 32 of said foot so as to permit the first metatarsal
9 head freely to evert and plantarflex under load, said
10 shell having a thickness distribution to carry the heel of
11 said foot backwardly inclined at an angle of between about
12 4 degrees and about 22.5 degrees relative to the ground
13 plane.

14 7. An orthotic device according to claim 6,
15 characterized in that said shell 28 has a curved portion
16 20 dimensioned to underlie and support the arch 38 of said
17 foot and to assist in carrying said heel of said foot.

18 8. An orthotic device according to claim 7, and
19 further characterized by a heel post 16 attached to said
20 shell 28 and dimensioned to underlie the heel of said foot
21 and extending forwardly toward the toes of said foot, said
22 heel post 16 terminating adjacent the heel bone 33 of said
23 foot, said heel post in concert with said shell carrying
24 the heel of said foot.

25 9. An orthotic device according to claim 8,
26 characterized in that said heel post 16 has a thickness
27 that increases from the heel 30 of said foot toward the
28 toes 34 thereof and from an outer part 14 of said foot
29 toward the arch 38 thereof.

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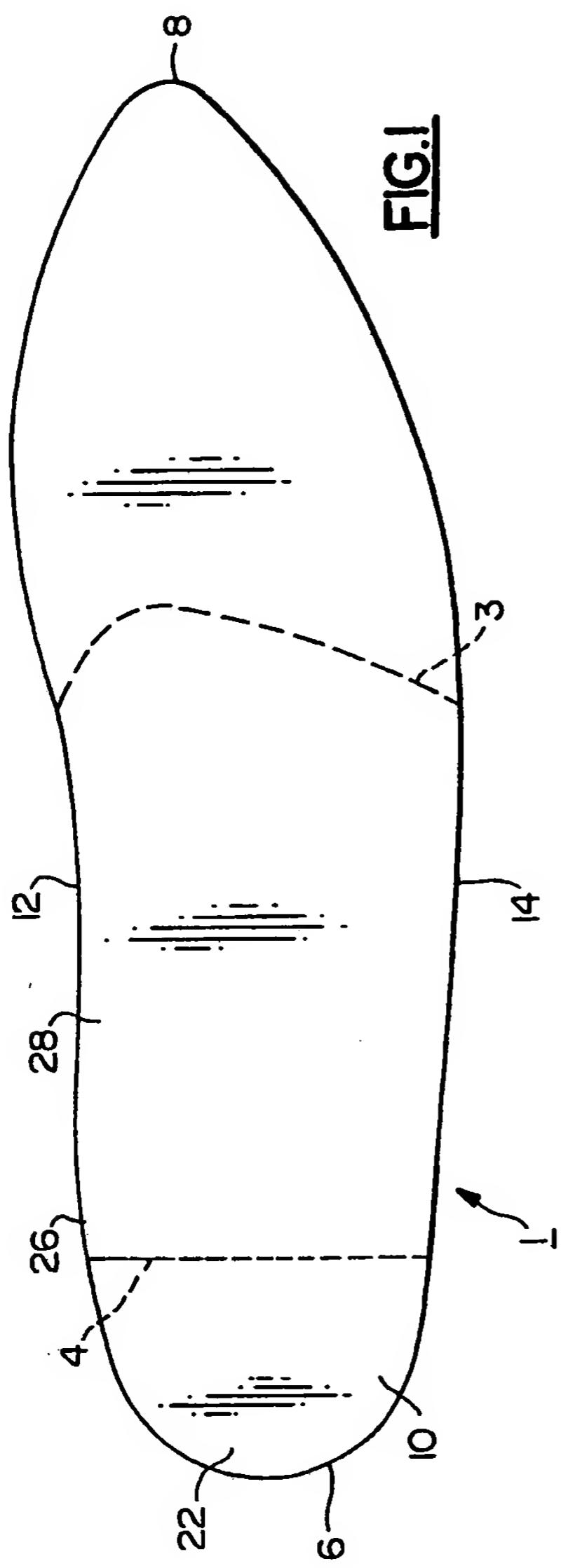


FIG.1

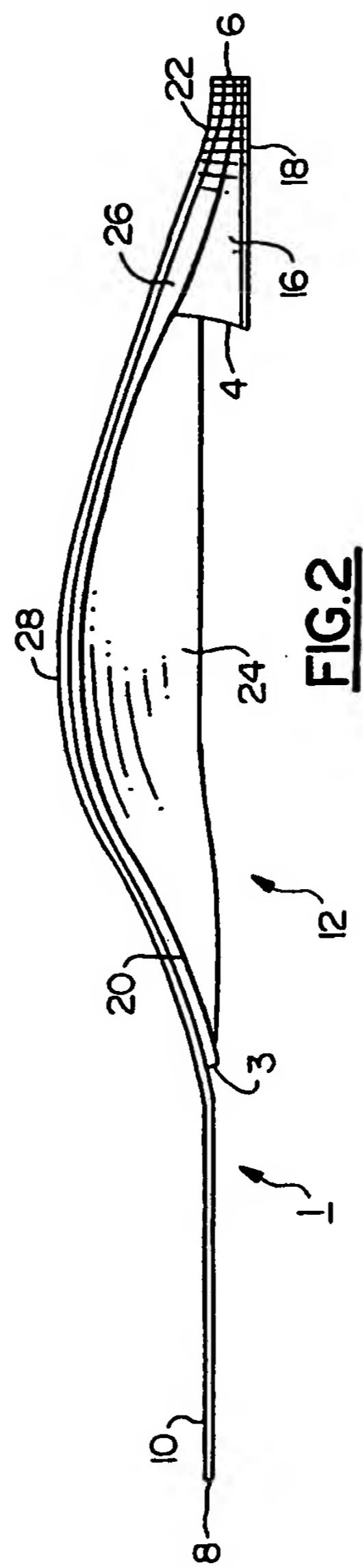


FIG.2

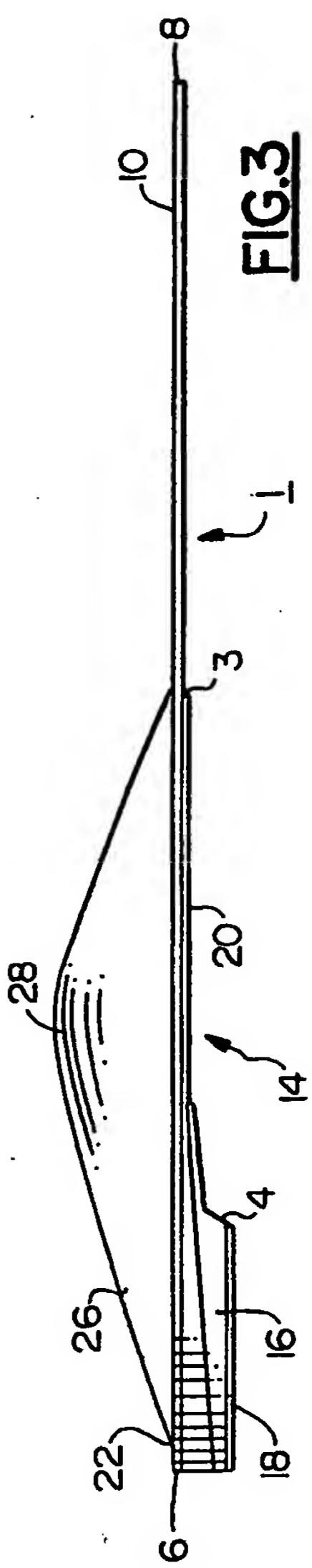


FIG.3

2/4

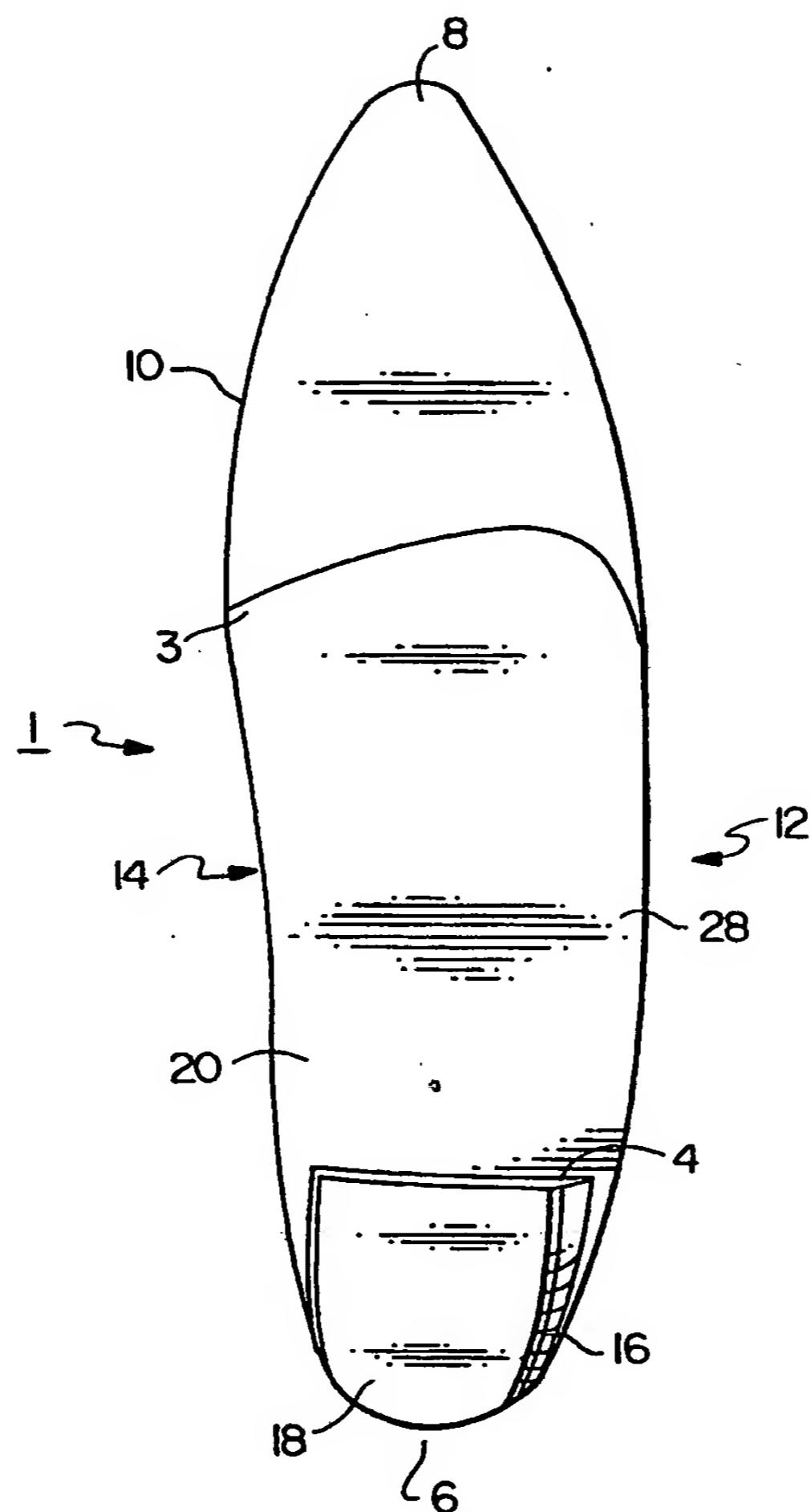
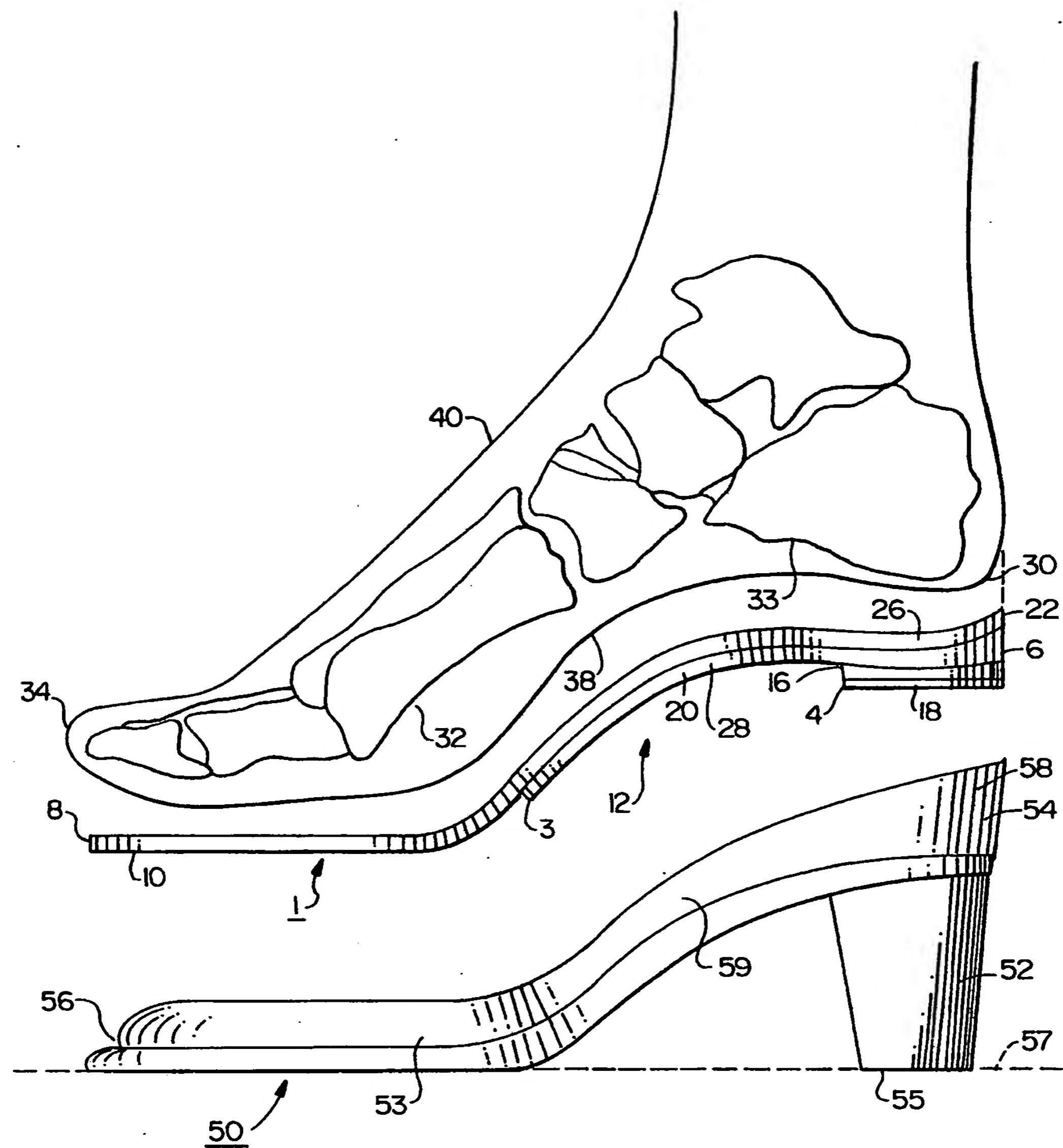


FIG.4

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**FIG.5**

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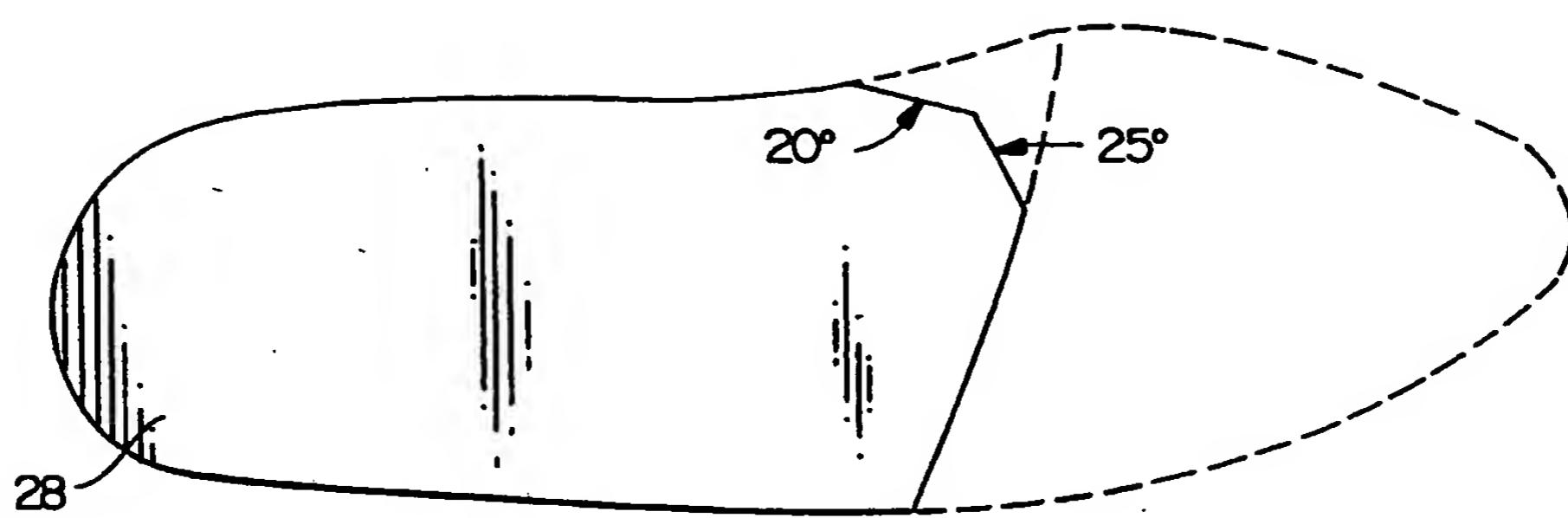


FIG.6



FIG.7

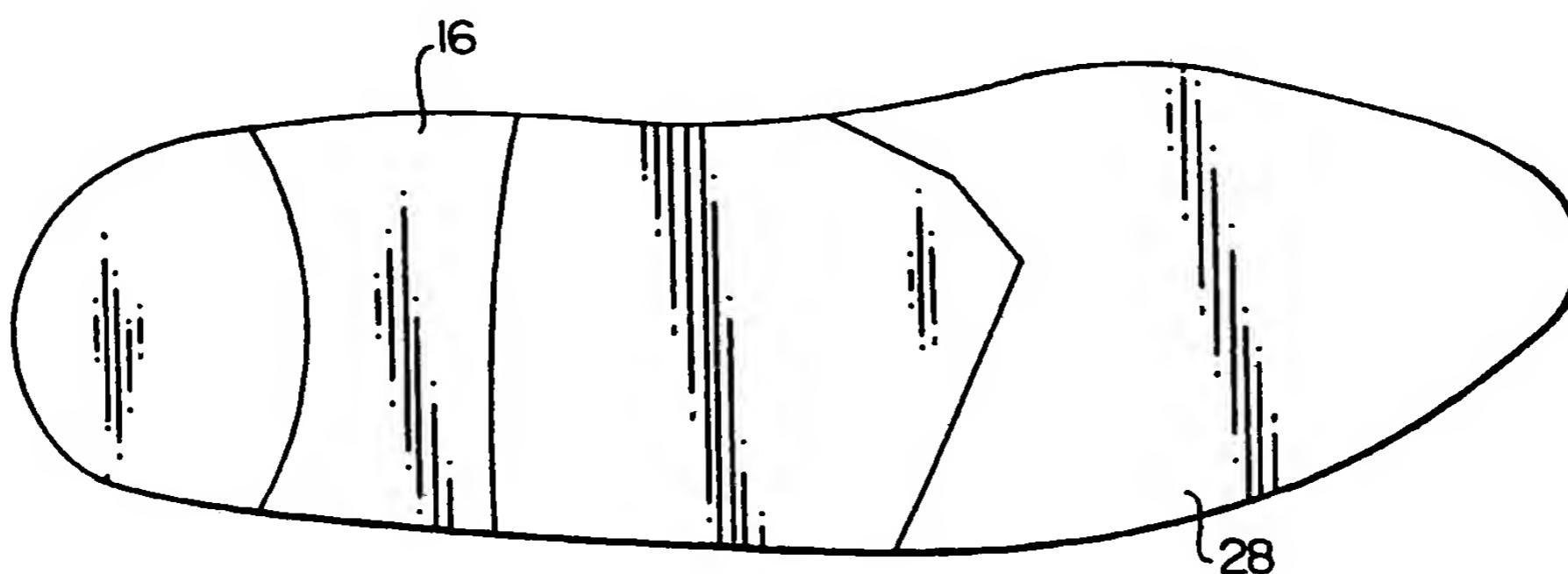


FIG.8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/03021

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) : A43B 7/14, 7/16, 7/22

US CL :036/43, 140

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 36/43, 140, 44, 71, 91, 92, 166, 169, 173, 181, 172, 174, 178, 180

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US, A, 2,823,469 (Eberhart) 18 February 1958, see figure 4.	6 1,4,5,6-9
X Y	US, A, 2,157,026 (Sochor) 02 May 1939, see figure 2	6 and 7 1 and 4-9
Y	US, A, 4,232,457 (Mosher) 11 November 1980, see whole reference	1-9
Y	US, A, 4,823,420 (Bartneck) 25 April 1989, see elements 48 and 40	2 and 3
Y	US, A 2,415,580 (Davis) 11 February 1947, see figures 3 and 4	3
A	US, A, 1,196,410 (Walker) 29 August 1916	1-9

 Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
* "A" document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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Date of the actual completion of the international search

17 MAY 1993

Date of mailing of the international search report

19 AUG 1993

Name and mailing address of the ISA/US
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INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,686,993 (Grumbine) 18 August 1987	1-9
A	US, A, 2,088,263 (Grouven) 23 June 1936	1-9
A	US, A, 1,417,170 (Hosmer) 23 May 1922	1-9
A	US, A, 4,759,357 (Allart et. al.) 26 July 1988	1-9